

## OBSERVATIONS ON THE EMERGENCE OF TWO SPECIES OF STONEFLIES<sup>1</sup>

Donald C. Hales<sup>2</sup> and Arden R. Gaufin<sup>3</sup>

Factors controlling the emergence of stoneflies differ with species. Evidence of this was observed on upper Trout Creek, Wasatch County, Utah during a two-year study, 1964-66. Two abundant species occupying the same habitat had very different emergence patterns. Adults of *Nemoura cinctipes* Banks were observed every month except December. Since they were collected in late November and early January, it is reasonable to assume they also emerged in December. *Isoperla petersoni* Needham and Christensen emerged only in late summer.

*Nemoura cinctipes* is a common stonefly species in streams of Western United States. Baumann (1967) compiled collecting records for the Wasatch Mountain Front, the eastern boundary of the Great Basin in Utah. Emergence there is associated with elevation. Adults begin to appear in late January at the lower elevations (1,500m) and emergence comes progressively later as elevation increases. Adults were noted in late June and early July at elevations of 2,620 to 2,730 m. Gaufin, et al., (1966) indicated that overall emergence time of *Nemoura cinctipes* in other areas in Utah is similar to that found in the Wasatch Mountain Front. Sheldon and Jewett (1968) showed emergence periods for stoneflies in Sagehen Creek, which drains from the east side of the Sierra-Nevada Mountains in Nevada County,

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<sup>2</sup>South Dakota Cooperative Fishery Unit, South Dakota State University, Brookings, SD 57006.

<sup>3</sup>Department of Biology, University of Utah, Salt Lake City, UT 84102.

California. *Nemoura cinctipes* emerged from February through June. The elevation was about 2,040 m.

The distribution of *Isoperla petersoni* is not as well defined as that of *Nemoura cinctipes*, but its occurrence is restricted to springs and to streams largely influenced by springs. Its emergence in Trout Creek was in late August and early September. Over its range adults emerge primarily from late May through November (Gaufin, et al., 1966).

Immature *Nemoura cinctipes* occurred over the entire two and one-half mile of Trout Creek, but were most abundant in the upper 500 meters. Nymphs of the stonefly, *Isoperla petersoni*, were abundant at the spring and in the upper 100 meters of the stream.

The main source of water in Trout Creek is a spring arising at its head (2,430 m elev.). The discharge of the spring ranged from 1.27 to 1.83 m<sup>3</sup> (4.5 to 6.5 cfs). Several smaller springs in the upper 1,200 meters of Trout Creek also contributed about 1 cfs. The water temperature at the main spring was 5.5 C and remained constant over the 2-year study. It varied only a few degrees in the first 500 meters downstream. The dissolved oxygen remained at or near saturation at all times. Substrate in the upper 75 to 100 m was heavily covered with moss, *Hygrohypnum bestii* (Ren. and Bryn. ex Ren.).

Most species of stoneflies have definite seasonal emergence patterns that are related to rhythms in the environment. Emergence of *Nemoura cinctipes* appears to be associated with vernal warming water temperatures. Water temperature is a reflection of elevation in mountain streams. Thus, emergence occurs earliest at the lower elevations and latest at the higher elevations.

Emergence of *Nemoura cinctipes* at Sagehen Creek occurred from February through June with the greatest numbers from late March to late April (Sheldon and Jewett, 1968). Sagehen Creek is fed by several springs. Brinck (1949) notes that prolonged emergence periods are characteristic of cold springs. In upper Trout Creek where the water temperature was constant, emergence period extended over the entire year. While it is apparent from general observations that adults were present in the greatest numbers during March, *Nemoura cinctipes* was a common form in collections throughout the year.

In contrast, *Isoperla petersoni* had a definite relatively short emergence period in Trout Creek. It is evident that water temperature does not influence emergence of this species, at least in the same way

as it does *Nemoura cinctipes*. Possibly emergence time is dependent upon accumulated temperature units or by the periodicity of other environmental factors.

In summary, *Isoperla petersoni* has very narrow tolerance limits. It is associated with moss in cold spring-fed streams. Its short emergence period may be associated with its restricted habitat. *Nemoura cinctipes*, on the other hand, is broadly tolerant and has adapted to a variety of conditions. It normally shows a definite emergence period, but in Trout Creek under uniform temperature conditions it reproduces the year around.

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ABSTRACT.—In a small, cold, spring-fed, mountain stream in which water temperature remained constant, *Nemoura cinctipes* Banks emerged year around and *Isoperla petersoni* Needham and Christensen emerged in late August—early September. *Nemoura cinctipes* normally exhibits a definite emergence periodically that appears to be associated with water temperature. Emergence of the two species is evidently controlled by different factors.—DONALD C. HALES, South Dakota Cooperative Fishery Unit, South Dakota State University, Brookings, SD 57006 and ARDEN R. GAUFIN, Department of Biology, University of Utah, Salt Lake City, UT 84102.

Descriptors: Plecoptera; Stoneflies; emergence stoneflies; *Isoperla petersoni*, emergence, *Nemoura cinctipes*, emergence; Utah, stoneflies.